WHAT IS CLAIMED IS:

1. An apparatus for illuminating a target, comprising:

a light source;

a first lens configured to receive light from the light source;

a diffractive diffuser configured to receive the light from the first lens and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target.

2. An apparatus for illuminating a target, comprising:

a light source chosen from at least one of a laser, an electroluminescent light source, an incandescent light source, an arc lamp, and a light emitting diode;

a first lens configured to receive light from the light source;

a diffractive optical element configured to receive the light from the first lens and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target.

3. The apparatus of Claim 1, wherein the light source is chosen from at least one of a laser, an electroluminescent light source, an chemoluminescent light source, an electrochemoluminescent light source, an incandescent light source, a fluorescent light source, an arc lamp, and a light emitting diode.

4. The apparatus of Claim 1, wherein the light source is chosen from a gas laser, a solid state laser, a fiber optical laser, and an organic based laser.

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5. The apparatus of Claim 1, wherein the light source comprises a coherent light source.

6. The apparatus of Claim 2, wherein the light source comprises a coherent light source.

7. The apparatus of Claim 1, wherein the light source comprises at least a first light source and a second light source.

8. The apparatus of Claim 7, wherein said first and second light sources respectively emit light having first and second optical spectrum, said second optical spectrum being different from said first optical spectrum.

9. The apparatus of Claim 1, where the first lens is configured to collimate the light from the light source.

10. The apparatus of Claim 1, wherein the second lens is configured to focus the regulated light to match a size of the selected area.

11. The apparatus of Claim 1, wherein the second lens comprises a lens system configured to collimate the regulated light and to reduce the regulated light to a size matched to a size of the selected area.

12. The apparatus of Claim 1, wherein the second lens comprises an objective lens.

13. The apparatus of Claim 12, wherein the objective lens is further configured collect light from the selected area.

14. The apparatus of Claim 1, wherein the first and second lenses are independently chosen from refractive optical elements, reflective optical elements, and diffractive optical elements.

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15. The apparatus of Claim 1, wherein at least one of the first lens and the second lens is chosen from at least one cylindrical lens.

16. The apparatus of Claim 1, wherein the diffractive diffuser comprises at least one diffractive optical element chosen from a transmission hologram, a reflection hologram, a plane hologram, a volume hologram, an absorption hologram, and a phase hologram.

17. The apparatus of Claim 1, wherein the diffractive diffuser comprises at least one diffractive optical element chosen from an optically etched diffractive optical element, an embossed diffractive optical element, a molded diffractive optical element, and a chemically etched diffractive optical element.

18. The apparatus of Claim 1, wherein the diffractive diffuser is configured to regulate the light and compensate for at least one of light intensity distributions and shapes of the light due to at least one of the light source and interaction of the light with optical elements of the apparatus.

19. The apparatus of Claim 1, wherein the diffractive diffuser is configured to post-compensate for effects of elements optically prior to the diffractive diffuser and pre-compensate for effects of elements optically subsequent to the diffractive diffuser.

20. The apparatus of Claim 1, further comprising an optical diffuser configured to remove speckle.

21. The apparatus of Claim 20, wherein the optical diffuser is located between the first lens and the diffractive diffuser.

22. The apparatus of Claim 20, wherein the optical diffuser is a rotating diffuser.

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23. The apparatus of Claim 1, wherein the regulated light is shaped to match a size and shape of the selected area.

24. The apparatus of Claim 1, wherein the regulated light matches a size of the selected target area after focusing of the regulated light by the second lens.

25. The apparatus of Claim 1, wherein the regulated light comprises a gradient intensity profile for substantially uniform illumination of the selected area at a non-normal angle of incidence.

26. The apparatus of Claim 1, wherein the apparatus is configured to substantially uniformly illuminate a square-shaped selected area of the target at a non-normal angle of incidence; and wherein the diffractive diffuser generates trapezoidal shaped regulated light having an optical intensity gradient increasing toward a shorter parallel side of the trapezoidal shaped regulated light.

27. The apparatus of Claim 1, wherein the apparatus is configured to substantially uniformly illuminate the selected area.

28. The apparatus of Claim 1, wherein the apparatus is configured to substantially uniformly illuminate the selected area when the regulated light illuminates the selected area at a non-normal angle of incidence.

29. The apparatus of Claim 1, wherein the diffractive diffuser regulates the light such that the regulated light has an intensity distribution suitable for substantially uniform illumination of the target.

30. The apparatus of Claim 1, wherein the apparatus is configured to illuminate the selected area with an intensity variation of less than 50%.

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31. The apparatus of Claim 1, wherein the apparatus is configured to illuminate the selected area with an intensity variation of less than 10%.

32. The apparatus of Claim 1, wherein the apparatus is configured to illuminate the selected area with an intensity variation of less than 5%.

33. The apparatus of Claim 1, wherein the apparatus is configured to illuminate the selected area with an intensity variation of less than 1%.

34. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 1% percent of the light from the light source onto the selected area.

35. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 10% percent of the light from the light source onto the selected area.

36. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 25% percent of the light from the light source onto the selected area.

37. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 50% percent of the light from the light source onto the selected area.

38. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 75% percent of the light from the light source onto the selected area.

39. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 90% percent of the light from the light source onto the selected area.

40. The apparatus of Claim 1, wherein the apparatus is configured to direct at least 10% percent of the light from the light source onto the selected area and to illuminate the selected area with an intensity variation of less than 25%.

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41. The apparatus of Claim 1, wherein the apparatus is configured to control a numerical aperture of the regulated light directed onto the selected area in order to produce a selected depth of field and a selected edge sharpness.

42. The apparatus of Claim 1, wherein the target comprises at least one optical fiber bundle.

43. The apparatus of Claim 1, wherein the target comprises at least one microcard.

44. The apparatus of Claim 1, wherein the target comprises at least one glass slide.

45. The apparatus of Claim 1, wherein the target comprises an optical fiber bundle comprising separate wells at terminal ends of optical fibers of the bundle.

46. The apparatus of Claim 1, wherein the target comprises at least one optically active species.

47. The apparatus of Claim 46, wherein the at least one optically active species is chosen from quantum dots and colloidal particles.

48. The apparatus of Claim 1, wherein the target comprises at least one luminescent species.

49. The apparatus of Claim 1, wherein the target comprises at least one fluorescent species.

50. The apparatus of Claim 1, wherein the target comprises at least one of a chemical recognition element and a biochemical recognition element.

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51. The apparatus of Claim 1, wherein the selected area comprises at least two spatially separate areas.

52. The apparatus of Claim 1, wherein the selected area is rectangular.

53. The apparatus of Claim 1, wherein the selected area is approximately 1mm x 1.5 mm.

54. An apparatus for illuminating a target, comprising:

a light source;

a first lens configured to receive light from the light source;

a diffractive diffuser configured to receive the light from the first lens and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target,

wherein the target comprises microwells.

55. An apparatus for illuminating a target, comprising:

a light source;

a first lens configured to receive light from the light source;

a diffractive diffuser configured to receive the light from the first lens and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target,

wherein the target comprises chemically functionalized beads.

56. An apparatus for illuminating a target, comprising:

a light source;

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a first lens configured to receive light from the light source;

a diffractive diffuser configured to receive the light from the first lens and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target,

wherein the target comprises a target array.

57. An apparatus to perform an assay on a sample, comprising:

a target configured to receive the sample;

a light source;

a first lens configured to receive light from the light source;

a diffractive diffuser configured to receive the light from the first lens, and to regulate the light into regulated light; and

a second lens configured to receive the regulated light and to direct the regulated light onto a selected area of the target.

58. The apparatus of Claim 57, wherein at least one of the target and the sample comprises at least one optically active species.

59. The apparatus of Claim 57, wherein at least one of the target and the sample comprises at least one fluorescent species.

60. An apparatus to perform an assay on a sample, comprising:

a target configured to receive the sample;

a light source;

a first lens configured to receive light from the light source; and

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a diffractive diffuser configured to receive the light from the first lens, to regulate the light into regulated light, and to direct the regulated light onto a selected area of the target.

61. The apparatus of Claim 60, wherein at least one of the target and the sample comprises at least one optically active species.

62. The apparatus of Claim 60, wherein at least one of the target and the sample comprises at least one fluorescent species.

63. A method to provide illumination of a target, comprising: generating light from a light source; directing the light with a first lens to a diffractive diffuser; generating regulated light with the diffractive diffuser; and focusing the regulated light with a second lens onto a selected area of the target.

64. A method to produce an optical response, comprising generating light from a light source; directing the light with a first lens to a diffractive diffuser t; generating regulated light with the diffractive diffuser; and focusing the regulated light with a second lens onto a selected area of a target, wherein the selected area comprises at least one optically active species.

65. The method of Claim 64, wherein the at least one optically active species comprises at least one fluorescent species.

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66. A method to provide illumination of a target, comprising: generating light from a light source chosen from at least one of a laser, an incandescent light source, a fluorescent light source, an arc lamp, and a light emitting diode; directing the light with a first lens to a diffractive optical element; generating regulated light with the diffractive optical element; and focusing the regulated light with a second lens onto a selected area of the target.

67. An analysis method, comprising generating light from a light source; directing the light with a first lens to a diffractive diffuser; generating regulated light with the diffractive diffuser; delivering the regulated light onto a selected area of a target, said target comprising at least one optically active species; and detecting changes in an optical signature of the at least one optically active species.

68. The method according to claim 67, wherein the at least one optically active species comprises at least one fluorescent species.